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THE OBJECTIVES OF THE INTERIM RESPONSE ACTION FOR THE REMEDIATION OF BASIN F LIQUID ARE TO:

1. SELECT THE FINAL TREATMENT PROCESS
2. CONDUCT PREDESIGN TESTING AT T-THERMAL'S EXISTING SUBMERGED QUENCH INCINERATION FACILITY AT CONSHOHCKEN, PA
3. DEVELOP AN ENGINEERING DESIGN PACKAGE FOR THE SELECTED TREATMENT PROCESS
4. CONSTRUCT THE NECESSARY FACILITY.

THIS FINAL DECISION DOCUMENT PROVIDES SUMMARIES OF:

1. ALTERNATIVES CONSIDERED
2. SIGNIFICANT EVENTS LEADING TO THE INITIATION OF THE IRA
3. THE IRA PROJECT
4. THE COMMUNITY INVOLVEMENT PROGRAM
5. THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, STANDARDS, CRITERIA, AND LIMITATIONS (ARAR'S) ASSOCIATED WITH THE PROGRAM.

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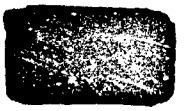

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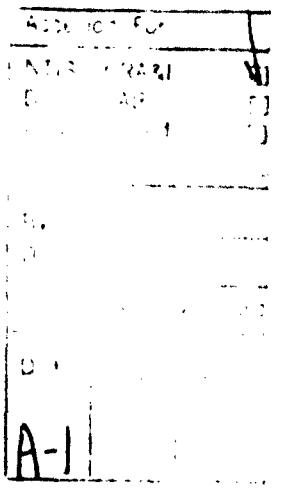

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Prepared for:

U.S. ARMY PROGRAM MANAGER'S OFFICE
FOR ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

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EXECUTIVE SUMMARY

The Army has selected submerged quench incineration (SQI) to thermally treat 8.5 million gallons of stored liquid from Basin F at Rocky Mountain Arsenal as an Interim Remedial Action (IRA). The SQI consists of a feed system to inject the Basin F liquid into the incinerator; the high temperature incinerator with a quench chamber to cool the gases and dissolve the molten salts from combustion; a spray dryer; and associated air pollution control equipment.

ALTERNATIVES CONSIDERED

The selection process was conducted in accordance with procedures for remedy selection prescribed by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Contingency Plan. These steps are described in detail in the Treatment Assessment Report issued in December 1989. They included a screening-level evaluation of all types of technologies available to treat Basin F liquid; detailed engineering evaluation of the five most promising treatment alternatives; and a preliminary risk assessment of on-site and off-site treatment alternatives. More than 40 different technologies were initially screened and subsequently narrowed to the five most promising technologies:

- Electric Melter Furnace
- Solidification
- Submerged Quench Incinerator (SQI)
- Wet Air Oxidation
- Wet Air Oxidation with Powdered Activated Carbon Bio-Treatment

Based on the technical evaluation, SQI was selected as the preferred alternative for treatment of Basin F liquid.

DECISION DOCUMENT COMMENT/RESPONSE PROCESS

The proposed Decision Document was released for public comment on 28 December 1989. A public meeting was held on 11 January 1990 to inform and discuss with the public the Army's proposed selection of SQI. Comments were received from the U.S. Environmental Protection Agency (EPA), State of Colorado, Tri-County Health Department, U.S. Department of Interior Fish and Wildlife Service, Shell Oil Company, and a number of individuals and groups, including the National Toxics Campaign and the League of Women Voters. The comments are addressed in Volume II of this Decision Document.

The comments generally agreed with and supported the proposed decision of on-site submerged quench incineration. The reviewing organizations and public did express concerns about predesign testing, design, and operation of SQI. Their comments resulted in the following changes being made:

- The process brine will be spray dried and disposed of at an appropriate off-site hazardous waste landfill.

- In addition to the existing plan to test for optimal nozzle performance and metals emissions removal, the predesign tests will also include an analysis for dioxins and furans in the liquid feed and air emissions.

- The Army agrees to independent oversight by an engineering organization retained by EPA and reporting to all Federal Facility Agreement Organizations (Army, EPA, Shell) and the State of Colorado.

CONCLUSION

The EPA, State of Colorado and Shell Oil Company concur on the selection of SQI to treat the Basin F liquid. The Final Decision Document reflects

several appropriate changes to address the major concerns of the public on the proposed decision for SQI to treat the Basin F liquids. It is believed that the changes will accommodate these concerns.

1.0 INTRODUCTION

The Interim Response Action (IRA) for the remediation of Basin F liquid at the Rocky Mountain Arsenal (RMA) is being conducted as part of the IRA process for RMA in accordance with the Federal Facility Agreement (FFA). Remediation of Basin F at RMA has been the subject of a two-part Interim Response Action for soils and sludges, and liquid, respectively. This decision document presents the results of the assessment and selection process for the second portion of this IRA: treatment and disposal of Basin F liquid now contained in three above-ground storage tanks and one double-lined and covered pond, Pond A. The subject of this decision document is selection of a method to achieve that final treatment and disposal.

The Federal Facility Agreement states that RMA is subject to the cleanup standards in Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and the provisions of the National Contingency Plan for Oil and Hazardous Substances (NCP - for reference to CERCLA and NCP, see FFA, 6.2 (j)). Section 121 (b)(1) of CERCLA expresses a preference for selection of remedial actions that employ treatment methods that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances. (See also, NCP Final Rule, Sections 300.430(e)(3)(i) and (e)(9)(iii)(A), Federal Register, V. 55, No. 46, March 8, 1990). The FFA (Section 22.1(f)) defines the Basin F IRA to include temporary storage of Basin F liquid; the term of temporary storage is tied to the service life of the above-ground storage tanks. By agreement between the Army, Shell and the EPA, the term of temporary storage will not exceed five years from the time of emplacement (May, 1988). Hence, remedial alternatives considered were restricted to those that would meet the cleanup standards of CERCLA, and that could be completed within the five-year timeframe.

Alternative methods for treatment and disposal of Basin F liquid have been reviewed based on their overall protectiveness of human health and the

environment; compliance to the maximum extent practicable with Applicable or Relevant and Appropriate Requirements (ARARs); reduction in toxicity, mobility, or volume; short- and long-term effectiveness; implementability; and cost.

This decision document describes the Army's decision for the type of treatment system to be used, but does not describe engineering details on this selected system. These details will be presented in the Implementation Document, to be issued subsequent to the finalization of the decision. Engineering details that will be included in the Implementation Document but which are not discussed in this document are

- Configuration of air pollution controls
- Standard - setting procedures for selected non-regulated compounds
- Decision on the need for and type of metals recovery process to be applied to residuals

2.0 HISTORY OF BASIN F LIQUID INTERIM RESPONSE ACTION

Rocky Mountain Arsenal (RMA) occupies over 17,000 acres (approximately 27 square miles) in Adams County, directly northeast of metropolitan Denver, Colorado (See Figure 2-1). RMA was established in 1942 and has been the site of manufacture of chemical incendiary munitions and chemical munitions demilitarization. Agricultural chemicals including pesticides were manufactured at RMA from 1947 to 1982.

In 1956, an evaporation pond called Basin F was constructed in the northern part of RMA (Figure 2-2). Basin F had a surface area of 92.7 acres and a capacity of approximately 243 million gallons. The basin was created by construction of a dike around a natural depression and was lined with a 3/8-inch catalytically blown asphalt membrane. An earth blanket approximately one foot thick was placed on top of the membrane to protect it. An industrial sewer consisting of vitrified clay pipe with chemically resistant sealed joints was installed between Basin F and the facilities where the wastes were generated. From August 1957 until its use was discontinued in December 1981, Basin F was the only evaporative disposal facility in service at RMA.

In 1986, the Department of the Army, Shell Oil Company, and the U.S. Environmental Protection Agency (EPA) Region VIII, agreed that an accelerated remediation be undertaken pursuant to CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) to contain the liquid and contaminated soils in and under Basin F. In a June 5, 1987 report to the court, the Organizations and the State agreed that fourteen interim actions, including the Basin F IRA, were necessary to expedite the cleanup of RMA.

Proposed consent decrees, outlining RMA cleanup objectives and responsibilities, were lodged in U.S. District Court in February and June, 1988, but were never entered by the court. In February 1989, a Federal Facility

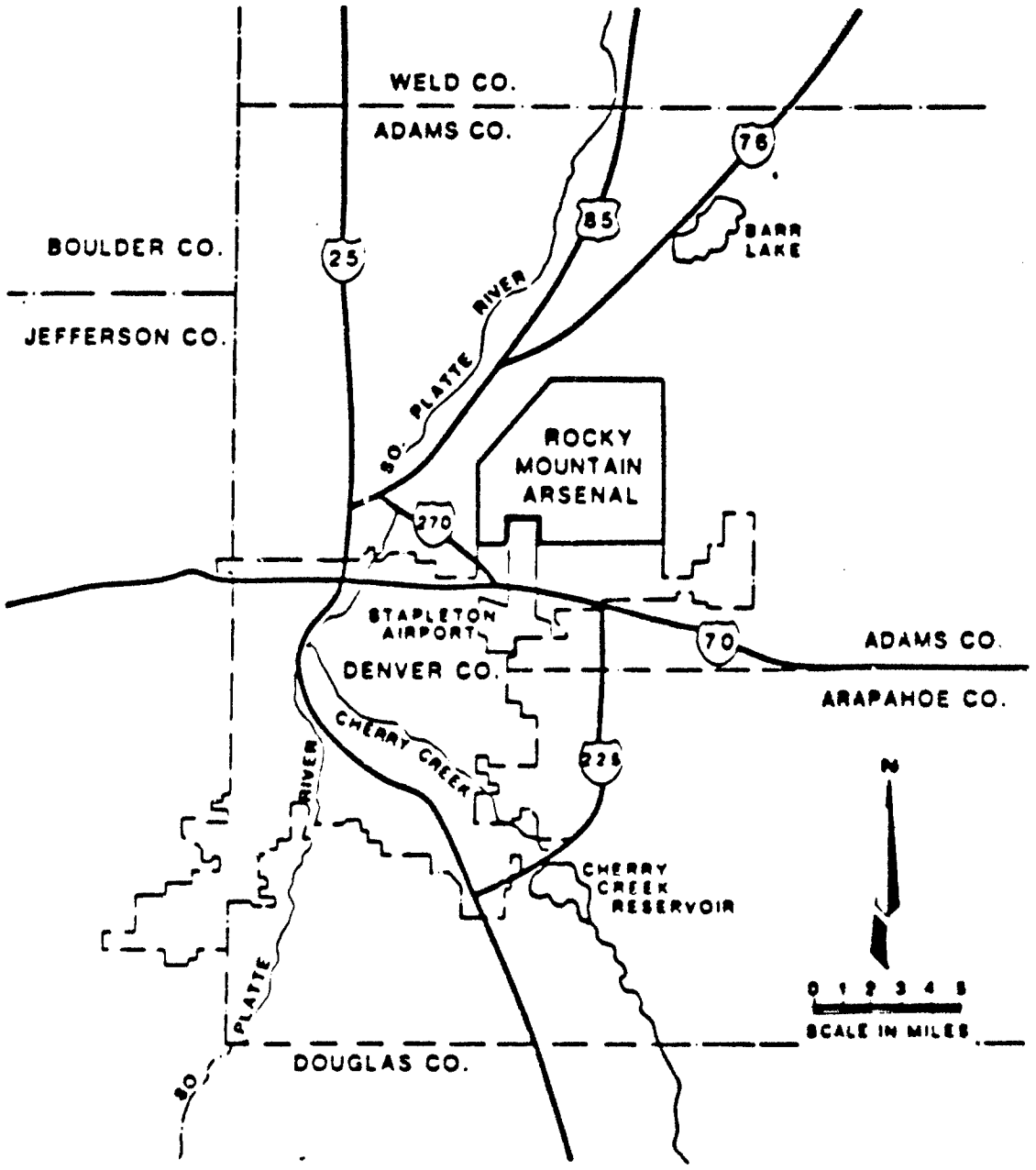
Agreement was entered into pursuant to CERCLA by the Environmental Protection Agency, the Army, the Department of Interior, the Department of Health and Human Services, the Department of Justice and Shell Oil Company (U.S. Environmental Protection Agency, et. al., 1988). The Army and Shell Oil Company agreed to share certain costs of the remediation, which was to be developed and performed under the oversight of the U.S. EPA, with opportunities for participation by the State of Colorado. The long-term remediation is a complex task that will take several years to complete.

The Federal Facility Agreement specified thirteen Interim Response Actions determined to be necessary and appropriate. (Two of the fourteen interim actions have been completed and one new interim action was added.) Remediation of Basin F liquid and sludges and soils is one of the thirteen IRAs, and is to be addressed in two parts. The first part, now completed, was removal of the liquids to secure storage, and removal and stockpiling of the soils and sludges in a double-lined and capped temporary waste pile. The second part concerns Basin F liquid treatment, and is addressed in this Decision Document. The time frame for completion of this IRA is tied to the service life of the above-ground storage tanks and is set at five years from May, 1988.

In the first part of Basin F remediation, Basin F liquid was transferred to three lined steel storage tanks and to one double-lined covered pond. Transfer of Basin F liquid to tanks and Pond A for interim storage was initiated in May, 1988 and completed in December 1988. Presently approximately 4 million gallons of liquid are stored in the tank farm and 4.5 million gallons are stored in Pond A.

The present Interim Response Action for Basin F liquid addresses treatment and disposal of the liquid in the storage tanks and Pond A. This IRA was initiated in September, 1988. It includes characterization of the stored Basin F liquid, selection of a treatment alternative for the liquids, testing of the selected treatment technology, and detailed engineering

design of the remedial treatment process. The first steps of this work, characterization of the liquids and selection of a preferred treatment alternative, were done in accordance with the five-step process for remedy selection prescribed generally by Section 121 of CERCLA, and detailed in the NCP (Sections 300.415 and 300.430 (e)). These steps are described in detail in the Treatment Assessment Report (Woodward-Clyde Consultants, 1989b). The remaining steps, predesign testing at an existing facility and detailed engineering design, remain to be done.



Job No. 22206	MAP OF RMA AND DENVER VICINITY
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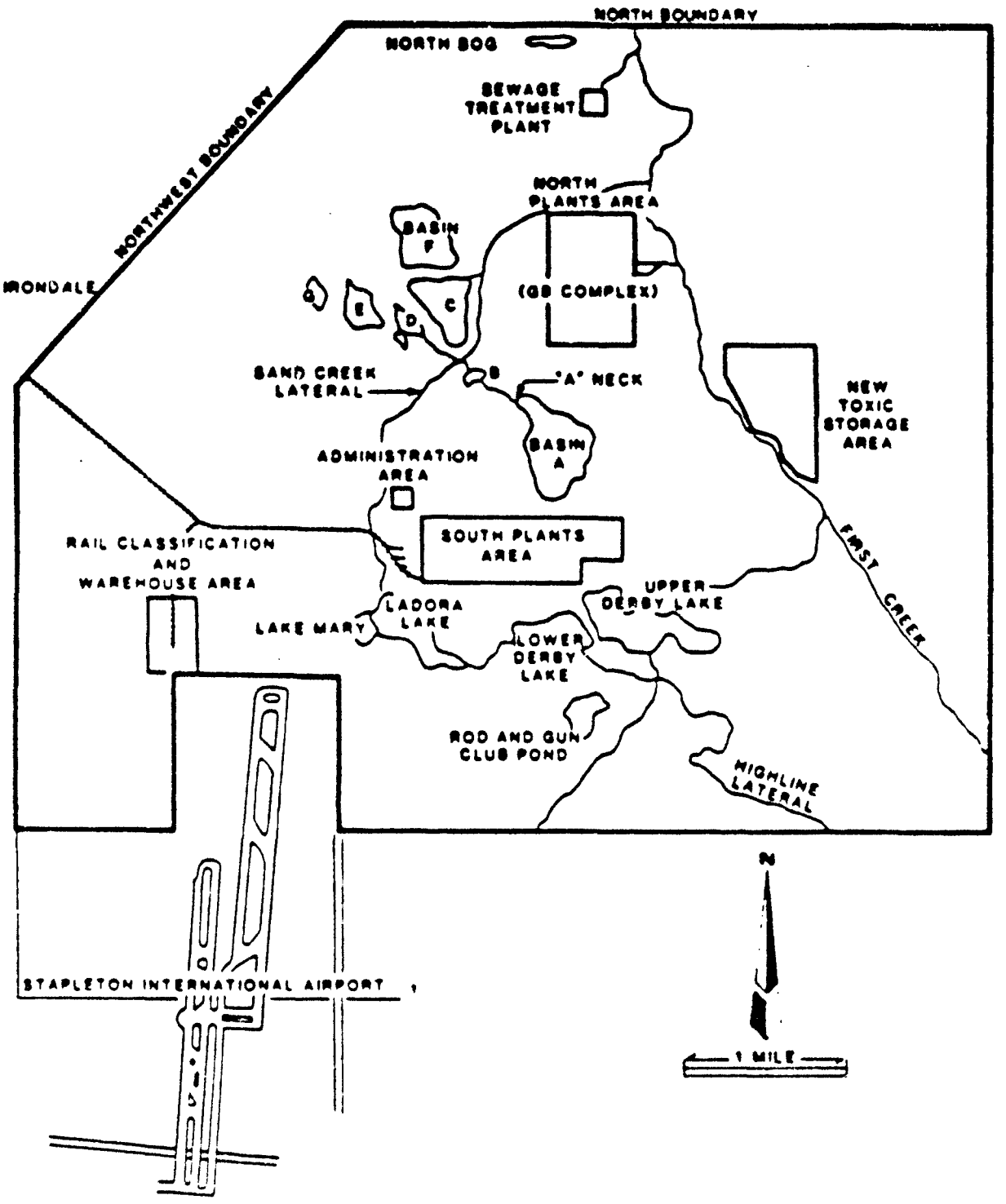
Date 10/21/88	

FIG. 2-1



Job No: 22206	HISTORIC MAP OF RMA SHOWING SITES OF FORMER EVAPORATIVE BASINS
Prepared by R C C	
Date 10/21/88	

FIG. 2-2

3.0 INTERIM RESPONSE ACTION OBJECTIVES

The objectives of this IRA for Basin F liquid treatment are to

- Select the final treatment process for Basin F liquid currently stored in tanks and Pond A
- Conduct predesign testing at T-Thermal's existing SQI facility in Conshohcken, PA, to support engineering design of the selected treatment process (a treatment evaluation has already been performed on the selected alternative)
- Develop an engineering design package for the selected treatment process
- Construct the facility and safely treat Basin F liquid

The screening and evaluation of potentially feasible treatment alternatives is described in detail in Section 4.0, Interim Response Action Alternatives. Certain screening criteria controlled the identification and screening of alternative technologies:

- Demonstrated ability to treat the waste, based on bench scale or pilot tests
- Ability to meet ARARs
- Ability to process the waste within the five-year timeframe
- Orientation to the primary remedy selection objective of CERCLA, to achieve overall protectiveness of human health and the environment
- Orientation to the CERCLA guidance stressing permanent solutions that reduce toxicity, mobility, or volume of hazardous substances

The final evaluation of alternatives was based on a set of selection criteria listed in CERCLA (Section 121(b)) and described in the National Contingency Plan (Section 300.430(e)). These criteria are

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) to the maximum extent practicable
- Reduction of toxicity, mobility, or volume
- Short-term and long-term effectiveness
- Implementability
- Cost

The objective of the Treatment Assessment Study was to identify a treatment alternative that performed best in terms of these criteria, and recommend this as the preferred remedial alternative.

This decision document provides a summary of the alternatives considered, a chronology of the significant events leading to the initiation of this IRA, a summary of the IRA project, a summary of the community involvement program for this IRA, and a summary of the ARARs, standards, criteria, or limitations associated with the program.

As specified in the Federal Facility Agreement, by destroying the contaminated liquid this Interim Response Action will, to the maximum extent practicable, be consistent with and contribute to the efficient performance of the Final Response Action.

4.0 INTERIM RESPONSE ACTION ALTERNATIVES

4.1 REVIEW OF ALTERNATIVES

Treatment alternatives were assessed in the "Treatment Assessment Report" (Woodward-Clyde Consultants, 1989b). The alternatives evaluated included the following:

Off-Site Alternatives
- Existing Off-Site Army Facilities
- Existing Off-Site Commercial Facilities
  - Deep Well Injection
  - Hazardous Waste Incinerators
- Associated Transport Facilities
  - Pipeline
  - Tank Trucks
  - Rail Cars

On-Site Alternatives
- Existing Arsenal Facilities
- Newly Constructed Arsenal Facilities
  - Electric Melter Furnace
  - Solidification
  - Submerged Quench Incineration
  - Wet Air Oxidation
  - Wet Air Oxidation with Powdered Activated Carbon Bio-Treatment (PACT)

A brief summary of the technical characteristics and the strengths and weaknesses of these treatment alternatives is given below. All of the on-site, newly constructed treatment alternatives can be designed and implemented to be protective of the community and the workers, and to meet ARARs to the maximum extent practicable. Alternatives which reduce

contaminant toxicity, mobility, or volume are more protective of human health and the environment than alternatives that do not.

The greatest differences between the alternatives considered were seen in the areas of treatment efficiency (reduction of toxicity, mobility, or volume), and implementability (feasibility, reliability, availability). The following discussion focuses on characteristics of the alternatives that make each alternative distinctive from the others. Further details on these alternatives can be found in the Treatment Assessment Report (Woodward-Clyde Consultants, 1989b).

A summary of the treatment assessment study is presented at the end of this chapter.

Because of the history of the Basin F Liquid Disposal Interim Response Action, three types of alternatives which are often considered in the remedy selection process for CERCLA are not considered here. These types of alternatives include the No Action, Monitoring, and Institutional Controls alternatives. Since the present Interim Response Action directs the Army to choose a strategy for treatment and disposal of Basin F liquid now in storage, the No Action, Monitoring, and Institutional Controls alternatives have already been judged unacceptable for application to Basin F liquid.

Alternatives evaluated for treatment of Basin F liquid include the following:

4.1.1 Off-Site Alternatives

Existing Off-Site Army Facilities. Several U.S. Army installations operate or have operated hazardous waste incinerators for the demilitarization of chemical warfare agents or other military hazardous wastes. However, each of these facilities was constructed to address specific wastes from its

respective site and none has equipment designed to operate on the particular admixture of wastes found in Basin F liquid. Thus, these incinerators are technically unsuitable. Moreover, construction of a new, technically suitable incinerator for Basin F liquid at these sites is contrary to the intent of CERCLA, which contains a preference for on-site waste remediation where possible.

Existing Off-Site Commercial Facilities (Deep Well Injection). Direct disposal approaches like deep well disposal which involve no treatment are in opposition to the objectives of both CERCLA and the Federal Facility Agreement. Specifically, these approaches will not meet the requirement of providing "permanent and significant" reduction of toxicity, mobility, or volume. In addition, the direct disposal approach is generally irreversible and offers no opportunity for later treatment. The Federal Facility Agreement stipulates that the Basin F liquid remediation will attain Applicable or Relevant and Appropriate Regulations (ARARs) to the maximum extent practicable. Primary guidance (U.S. Environmental Protection Agency, 1988) defines reduction of toxicity, mobility, or volume as "permanent and significant reduction" through "destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media" (Section 7.2.3.3, Draft Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, U.S. Environmental Protection Agency, 1988). For this reason, deep well injection of Basin F liquid was rejected.

Existing Off-Site Commercial Facilities (Hazardous Waste Incinerators). A survey of the capabilities of existing commercial hazardous waste direct liquid injection incinerators showed that among all of the facilities in the nation which were contacted, only three sites with liquid injection incinerators are equipped for and willing to consider treatment of Basin F liquid. However, the actual technical suitability of equipment at these installations has not been proven. In addition, operators of each of these

three commercial facilities have indicated that they would require a treatment contract that would allow the facility to refuse, at any time and at their discretion, receipt of Basin F liquid for treatment. Thus, the commercial facilities would not guarantee that Basin F liquid would be treated within the remaining service life of the tanks, nor would they guarantee completion of treatment of all Basin F liquid.

Newly Constructed Off-Site Facility. A new treatment facility for Basin F liquid could be built off-site in a location that the Army could purchase or lease. Such a facility could be located such that it would be distant from any populated area, and thereby could presumably present a lower operational risk to humans. A new off-site facility, like any of the on-site options, could be designed and built to attain regulatory standards and achieve cleanup objectives. The drawbacks of a newly constructed off-site facility are the time required for permitting, and the requirement for and health concerns with transport of waste. In accordance with CERCLA, on-site facilities constructed and operated as a CERCLA response action on a CERCLA site do not require environmental permits from Federal, State, or local agencies since the CERCLA process substitutes for other permitting processes. An off-site facility, on the other hand, would be subject to a lengthy permitting process. The amount of time currently required to secure similar permits in Colorado is 3-5 years, due to the complexity of application data requirements and the number and duration of agency and other reviews. When the permitting time is added to the time required to design, test, build, and operate the treatment facility for Basin F liquid, the total time required for this off-site option exceeds the time available, as agreed to by the parties to the Federal Facility Agreement. Therefore, a newly constructed off-site facility was rejected as an option.

Associated Transport Facilities (Pipeline). Conveyance of Basin F liquid through a pipeline to an off-site hazardous waste facility was considered. Although transstate and interstate pipelines exist to convey fuel

products, such as natural gas and fuel oils, no pipeline suitable for liquid hazardous waste presently exists. Therefore, a separate pipeline would have to be built to transport Basin F liquid. The potential for leakage of Basin F liquid due to joint failure, corrosion failure, and freeze damage under Colorado weather conditions is substantial. Additionally, since Basin F liquid is a saturated or supersaturated brine solution, it could not be piped long distances without considerable dilution to prevent salt precipitation and line pluggage. Thus, the volume of wastes would be substantially increased. The cost of constructing a suitable pipeline and supplying the power to pump the Basin F liquid long distances would be greater than the cost of either off-site bulk transport or construction of an on-site treatment unit.

Associated Transport Facilities (Tank Trucks). The tank truck scenario evaluated in the Treatment Assessment Report (Woodward-Clyde Consultants, 1989b) was based on using tank trucks of approximately 5,000-gallon capacity to transport Basin F liquid off-site for treatment. These trucks would be owned and furnished by a transportation contractor. To complete treatment of Basin F liquid in the estimated 1.5 year treatment period, approximately 500,000 gallons would have to be transported per month. Depending on the location of the treatment facility, this could require using more than 20 tank trucks (assuming five round trips each per month) to transport Basin F liquid. Based on a survey of transportation contractors (Woodward-Clyde Consultants, 1989b), this number of tank trucks did not appear to be available from one company. Most available tank trucks are constructed of stainless steel material, which may not be compatible with highly corrosive Basin F liquid. There were only a few lined tank trucks available at the time of the survey. The risk assessment reported in the Treatment Assessment Report indicated that the risk of transporting Basin F liquid off-site by truck was significantly higher than the risk of transporting the liquid by rail car.

Associated Transport Facilities (Rail Cars). The use of rail cars, typically of 20,000-gallon capacity, was also evaluated in the Treatment Assessment Report. The risk of transporting Basin F liquid off-site for treatment by rail car was estimated to be low relative to any other transportation mode. Specialized rolling stock exists in sufficient numbers to accommodate shipments of Basin F liquid to an off-site location. Some of the rolling stock is lined; depending on the supplier, some tank cars might need to be lined prior to receiving Basin F liquid. Rail transportation of hazardous waste is relatively common in the United States.

4.1.2 On-Site Alternatives

Existing Arsenal Facilities. The use of existing treatment equipment at the Arsenal was considered. The only remaining treatment equipment includes three incinerators and two spray dryers. All three incinerators have not been used for over five years and have been decommissioned. Two are strictly solids incinerators and cannot be adapted for liquids. None of the three possesses air pollution control equipment that would meet present air emissions control standards. Additionally, all three incinerators and their air control systems have deteriorated from age and disuse and none is suitable for reuse.

The two spray dryer systems from the North and South plants, respectively, have likewise been decommissioned. The South plants unit was partly dismantled to provide parts for the North plants dryer system. Preliminary evaluation shows it would not be cost effective to reuse the North plant spray dryer in any proposed treatment process requiring a spray-drying step. The age and condition of the equipment indicate extensive and costly maintenance would be required to return it to operative condition. The anticipated maintenance cost is expected to meet or exceed the cost of new equipment.

It has been concluded, therefore, that no existing treatment equipment at the Arsenal can be applied to Basin F liquid remediation and any on-site alternatives would require the procurement and construction of a new facility.

Newly Constructed Arsenal Facilities. This group of alternatives includes the five technologies identified in the screening step of the Treatment Assessment Study. They are presented here in alphabetical order:

Electric Melter Furnace. The electric melter furnace would operate at high temperatures--about 2300°F--to destroy organic compounds in Basin F liquid. In the furnace (similar to a glass-making furnace), the organic compounds in Basin F liquid would be destroyed almost completely. The metals would form a molten salt that would float on top of the pool of glass which lines the bottom of the furnace. The molten salt would be removed from the furnace periodically, poured into forms, and cooled in preparation for final disposal. The exhaust gases would include a mixture of combustion byproducts and other gases. Exhaust gases released to the atmosphere from this process would be passed through air pollution control devices, would meet regulatory standards, and would be monitored to assure adherence to operating requirements.

Operation of the electric melter furnace would require the transportation of 8100 cubic yards of pure liquid anhydrous ammonia and 4400 cubic yards of sodium hydroxide into the Arsenal each year. Both compounds would be used in the air pollution control process. However, the risk assessment indicated that the amount and concentration of ammonia transported on-site for this alternative could present a health hazard. The electric melter furnace process would produce salts, containing metals, of about 27 percent of the volume of the original Basin F liquid. These salts could be disposed in an off-site hazardous waste landfill. The form and chemistry of produced salts are not suitable for subsequent metals recovery. For the five on-site treatment alternatives evaluated, the electric melter furnace

ranked at the low end of the mid-range of costs, with an estimated total project cost of $21.1 million. The electric melter furnace has not been commercially demonstrated to be feasible for destruction of wastes like Basin F liquid.

Solidification. The solidification process would mix various chemicals with the Basin F liquid to immobilize the metals and produce a solid. Organic compounds in Basin F liquid would be incorporated into the solid but would not be destroyed or immobilized and could be leached from the solid material. Because Basin F liquid contains large amounts of ammonia and nitrogen-containing compounds, chemicals would be added to react with these compounds and greatly reduce the release of ammonia during mixing and curing of the solid. The Basin F liquid would be pumped into two batch mixing units and mixed with Portland cement, fly ash, soil, and other agents to reduce ammonia emissions. Mixing units would be sealed during operation. The moist mixture would be discharged into disposable 50-gallon drums and held in an adjacent building for 15 days to complete the curing process. Control measures would be used to reduce fugitive emissions from the solidification process. Exhaust from the mixing and curing areas would be treated by air pollution control equipment to control particulates and gases. The exact nature and concentrations of emissions of organic chemicals as well as dust are not known or readily estimated for the solidification process. Due to the quantities of mixing materials handled, dust emissions could be substantial.

Solidification would require the transportation into the Arsenal of 17,300 cubic yards per year of phosphoric acid, plus comparably large quantities of other compounds, such as magnesium sulfate, flyash, and cement, primarily used to fix the materials and to reduce the amount of ammonia released during mixing. Solidification would produce solids of approximately three times the volume of Basin F liquid, which could be disposed in an off-site hazardous waste landfill. Solidification is a common technology for many types of wastes, but is not known to have been

applied to saturated brine or ammonia-bearing wastes like Basin F liquid in a commercial-scale operation. The solidified products of this process will meet present hazardous waste landfill leachability requirements, but are close to the acceptance threshold, and leachability testing prior to disposal may be required. Of the on-site treatment alternatives evaluated, solidification ranked as the most costly, with an estimated project total cost of $71.8 million.

Submerged Quench Incineration. The submerged quench incineration process would use a vertical downfired liquid incinerator. The liquid to be incinerated would be injected at the top of the furnace into a gas flame. Burning the liquid at high temperature (about 1900°F) would destroy the organic compounds in Basin F liquid almost completely. After incineration, all the combustion products would be forced downward and cooled in a liquid quench tank, to aid in washing out particulates and cleaning the exhaust gases. The high temperatures would melt noncombustible components of the Basin F liquid, producing molten salts which would flow down the walls of the incinerator and also be cooled in the quench chamber. The brine from this process will be dried in a spray dryer to produce a salt. The exhaust gases, which would include a mixture of combustion byproducts and other gases, would be passed through air pollution control devices. Exhaust gases released to the atmosphere from this process would meet regulatory standards and would be monitored to assure adherence to operating requirements established pursuant to Section 9.0.

Operation of the submerged quench incineration process would require the transportation onto the Arsenal of 2600 cubic yards per year of sodium hydroxide, a caustic compound used in the air pollution control process. The submerged quench incineration process would produce salts, of about 25 percent of the original volume of the Basin F liquid. These salts which contain metals could be disposed in an off-site hazardous waste landfill. Compared to the other on-site treatment alternatives evaluated, submerged quench incineration is the least costly, with an estimated project total

cost of $19.1 million. This process has been demonstrated commercially on organic contaminants in saturated brine wastes like Basin F liquid.

Wet Air Oxidation. In the wet air oxidation and spray drying process, Basin F liquid would be fed under pressure to an oxidation chamber operating at about 500°F. In the chamber, organic compounds in Basin F liquid would break down into simpler, less toxic compounds. A minimum of 95 percent of the toxic organics would be destroyed. The metals and many organic compounds would remain in the liquid, although some gas also would be released by the reaction. The liquid from the oxidation chamber would be treated to neutralize ammonia. Then the liquid and gas from the oxidation chamber would be fed to a spray dryer. The dried salts containing metals would be separated and packaged for shipment to an off-site hazardous waste landfill. The gases, which would contain some volatile organic compounds and ammonia, would be passed through air pollution control devices. Exhaust gases released to the atmosphere from this process would meet regulatory standards and would be monitored to assure adherence to operating requirements.

Operation of the wet air oxidation process would require the transportation into the Arsenal of 25,750 cubic yards per year of highly concentrated sulfuric acid and 2200 cubic yards of 50 percent sodium hydroxide. The sulfuric acid would be used to neutralize ammonia and the sodium hydroxide would be used in the air pollution control process. The wet air oxidation and spray drying process would produce salts, containing metals and some simple organic compounds, of about 64 percent of the total original volume of Basin F liquid. These salts could be disposed in an off-site hazardous waste landfill. The form of the dried salts would permit a metals recovery step, but the organic content of the salts could affect the purity of recovered metals and would remain in the salts to some degree anyway; hence, metals recovery for this process is of questionable utility. Compared to the other on-site alternatives evaluated, the wet air oxidation and spray drying process is in about the mid-range of costs, with an

estimated project total cost of $48.2 million. This process has been commercially demonstrated on liquid wastes like Basin F liquid.

Wet Air Oxidation with Powdered Activated Carbon Bio-Treatment (PACT). Wet air oxidation, PACT, and spray drying would destroy organic compounds in Basin F liquids by subjecting them to high pressure and moderately high temperatures in the presence of air. After passing through the pressurized oxidation chamber (operating at about 500°F), organic compounds would be broken down to simpler, less toxic compounds. The metals and many organic compounds would remain in the liquid, although some gases would be released by the reaction. Before liquid from the oxidation process was treated in the subsequent PACT process, it would be pretreated to remove copper and ammonia and would be diluted. The liquid could then be sent to enclosed aeration basins for PACT biotreatment. The carbon would adsorb and retain organic compounds in the aeration basins so that microorganisms would have time to break them down. After PACT treatment, the liquid would be concentrated and spray-dried in a dryer similar to that used in the wet air oxidation and spray drying process. The exhaust gases, which would include some volatile organic compounds and ammonia, would be passed through air pollution control devices. Exhaust gases released to the atmosphere from this process would meet regulatory standards and would be monitored to assure adherence to operating requirements. Overall, the wet air oxidation, PACT, and spray drying process would destroy a minimum of 99 percent of the toxic organics in Basin F liquid.

Operation of the process would require the transportation into the Arsenal of 25,750 cubic yards per year of highly concentrated sulfuric acid and 2200 cubic yards of 50 percent sodium hydroxide. The sulfuric acid would be used to neutralize ammonia and the sodium hydroxide would be used in the air pollution control process. The process would produce dried salts, containing some metals and simple organic compounds, of 72 percent of the volume of the original Basin F liquid. These salts could be disposed in an off-site hazardous waste landfill. Compared to the other on-site

alternatives evaluated, wet air oxidation, PACT, and spray drying is in the top of the mid-range of costs, with an estimated project total cost of $56.2 million. This process has been commercially demonstrated on wastes like Basin F liquid.

4.1.3 Conclusions

Off-site options. Of the off-site options, use of existing military treatment facilities, use of existing deep-well disposal facilities, and construction of a new off-site facility are not feasible. Use of an existing off-site commercial incinerator may be feasible. Transportation of wastes by pipeline to an off-site location is not feasible. Transportation by truck and by rail are feasible; rail transport is preferred. Due to risks associated with waste transportation, use of an existing off-site commercial incinerator presents higher overall risks than any on-site option.

Overall Protectiveness. Of the on-site options, the electric melter furnace and submerged quench incineration have the highest organic chemical destruction efficiencies, and are therefore the most protective of human health and the environment. Wet air oxidation with PACT and wet air oxidation alone will destroy organic chemicals, but not as completely as incineration. Solidification does not provide any treatment to organics.

Air Emissions. Of the on-site options, all processes but solidification are expected to be able to be designed to meet ARARs, and will have monitoring to assure adherence to operating requirements. Solidification emissions, particularly fugitive dust, will be difficult to estimate, and may present monitoring and control problems.

Use of hazardous chemicals. All of the on-site options will require importation of process materials to RMA. The chemicals required for the electric melter furnace present higher risks than chemicals required for any other process. The chemicals required for submerged quench incineration present lower risks than chemicals required for any other process.

Residuals. The two incineration processes produce as residuals a metal-bearing salt that can be landfilled off-site. The salts from the submerged quench process are suitable for a subsequent metals recovery step, while the salts from the electric melter furnace are not. The wet air oxidation processes produce as interim or final residuals a metal-bearing and organic-bearing salt that is not generally suitable for metals recovery, although removal of impure metals will permit subsequent organics removal (PACT) and will reduce the quantity of hazardous residuals. Solidification produces a hazardous waste that can be landfilled off-site, but which is leachable for organics. The solidified residual is not suitable for subsequent treatment steps.

Waste Volume. The two incineration processes produce a volume of residuals that is about 26 percent of the original waste volume. The wet air oxidation processes produce a volume of residuals that ranges from 64 to 72 percent of the waste volume. The solidification process produces a waste product that is 300 to 500 percent of the original waste volume.

Commercially demonstrated process. Of the on-site options, the submerged quench incinerator and the wet air oxidation processes have been demonstrated commercially on saturated brine wastes like Basin F liquid. Solidification has been demonstrated commercially on many types of wastes, but not on saturated brine, ammonia-bearing wastes like Basin F liquid. The electric melter furnace has not been commercially demonstrated for liquid hazardous wastes.

Cost-effectiveness. Of the on-site options, the electric melter furnace and submerged quench incinerator are the least expensive. The wet air oxidation processes are two to two and one-half times as expensive as incineration, and solidification is three to three and one-half times as expensive as incineration.

4.2 TREATMENT ASSESSMENT STUDY

The treatment assessment study to identify feasible treatment or disposal alternatives and select a preferred alternative consisted of five steps:

- Waste Characterization
- Screening of Technologies and Development of Alternatives
- Treatability Studies
- Detailed Evaluation of Alternatives
- Selection of a Preferred Alternative

4.2.1 Waste Characterization

In addition to reliance on historical sampling and analysis of Basin F liquid, characterization of the Basin F liquid in this IRA included a current round of sampling and analysis of the wastes to determine their chemical and physical properties in relation to engineering design and performance requirements of potential treatment processes, and to provide the basic chemical parameters needed for a risk analysis of alternatives selected for detailed evaluation.

Two samples of the Basin F liquid from Pond A were collected in December 1988. These samples were submitted for chemical testing and the results were compared to those from other recent Basin F liquid sampling efforts. Details of this testing are given in the Treatment Assessment Report.

This testing confirmed that Basin F liquid is almost completely saturated with common salts, ammonium salts and other nitrogen-containing compounds. The liquid also contains heavy metals such as copper and arsenic. In addition, the liquid contains low levels of pesticides and byproducts of pesticide and chemical warfare agent manufacturing. The characteristics of Basin F liquid constrain the choice of treatment and disposal techniques and may require special design of treatment alternatives. For example, Basin F liquid may precipitate solid salts or release ammonia gas under certain process conditions. The amounts of heavy metals, particularly copper, in the Basin F liquid may preclude certain treatments for the organic compounds also contained in the liquids. The high salt content of the liquid is corrosive to many kinds of treatment equipment.

4.2.2 Screening of Technologies and Development of Alternatives

Forty different treatment technologies were identified and evaluated for their ability to tolerate the chemical and physical characteristics of Basin F liquid and achieve the general cleanup objectives of the IRA. The forty technologies encompassed all four of the basic strategies known to treatment science:

- Thermal Destruction
- Immobilization
- Separation
- Chemical/Biological Treatment

Of the forty technologies, only twelve were found to be potentially feasible, given the physical and chemical properties of Basin F liquid. No separation technology was found to be feasible. The twelve potentially feasible technologies were studied further in terms of overall protectiveness, implementability within the stipulated time frame, and ability to meet Applicable or Relevant and Appropriate Requirements (ARARs). In the end, five technologies were judged to be feasible, protective of human

health and the environment, able to meet ARARs and implementable within five years. These five are

- Electric Melter Furnace (Thermal Destruction Process)
- Solidification (Immobilization Process)
- Submerged Quench Incineration (Thermal Destruction Process)
- Wet Air Oxidation (Chemical Process)
- Wet Air Oxidation with Bio-treatment (Chemical-Biological Process)

In developing remedial alternatives that would use these technologies, both on-site and off-site locations were considered. For off-site locations, three scenarios were considered:

- Use of Existing Military Waste Treatment Facilities
- Construction of a New Off-Site Treatment Facility
- Use of Existing Commercial Waste Treatment Facilities

There are no existing military facilities of the required types or of any other potentially suitable type that is permitted to process Basin F waste. Construction of a new facility was ruled out because there is insufficient time for design, permitting, and testing within the limited time frame for this IRA. Three existing commercial facilities (all incinerators) were identified that might be capable of processing Basin F liquid. Use of existing treatment facilities on RMA property was considered and ruled out because no facilities exist that could be upgraded to process Basin F liquids and meet ARARs.

The screening process concluded with the development of seven remedial alternatives:

- Off-Site Incineration, Using Railroad Transport of Waste
- Off-Site Incineration, Using Truck Transport of Waste

- On-Site, Newly Constructed Electric Melter Furnace
- On-Site, Newly Constructed Solidification Facility
- On-Site, Newly Constructed Submerged Quench Incinerator
- On-Site, Newly Constructed Wet Air Oxidation Unit
- On-Site, Newly Constructed Wet Air Oxidation Unit with Powdered Activated Carbon Bio-treatment (PACT)

Preliminary Risk Assessment. In conjunction with the screening of technologies and development of alternatives, a preliminary risk assessment was performed. Detailed results of this study are presented in the Treatment Assessment Report. Risks of both on-site and off-site treatment alternatives were evaluated and the results indicated that there should be very low potential cancer risks and no significant non-cancer health hazards from any of the treatment processes themselves. However, the risk assessment indicated that there may be some potentially significant health hazards associated with the transportation of Basin F liquid (to an off-site treatment facility) or from the transportation of treatment chemicals (on-site for the electric melter furnace, one of the treatment processes evaluated). The potential health hazard risks were associated with possible exposure to the ammonia content of Basin F liquid and possible exposure to the pure liquid anhydrous ammonia which would be required for the electric melter furnace process. Based on this preliminary health risk assessment, off-site treatment options were not considered further in the Treatment Assessment Report.

4.2.3 Treatability Studies

Bench-scale or pilot-plant tests were performed on Basin F liquid using each of the twelve technologies identified in the initial screening step as potentially feasible. These treatability studies were done over an eleven-year period from 1978-89. Successful bench-scale or pilot-test data exist for all of the five technologies retained in screening and used in the development of remedial alternatives. This is to say that all of the

alternatives selected for detailed evaluation had been demonstrated to be capable of treating Basin F liquid.

4.2.4 Detailed Evaluation of Alternatives

Five alternatives were retained for detailed evaluation (all newly-constructed on-site facilities). Each alternative was designed at a conceptual level, and an assessment of probable performance was made. This assessment included preparation of a detailed process description; sizing of the treatment alternative to meet the waste volume and schedule for this IRA; preparation of a materials balance to estimate volumes and quantities of feed, process, discharge, and residuals streams; assessment of technical performance, in terms of reduction of toxicity, mobility, or volume; evaluation of the implementability of the process (technical maturity, track record, etc.); estimates of capital and operating costs; and identification of regulatory issues. This information (summarized in Section 4.1) was used in the selection of a preferred remedial alternative.

4.2.5 Selection of a Preferred Alternative

A semiquantitative scoring and ranking technique was used to evaluate the five remedial options and select a preferred alternative. The technique derived from and was based on multiattribute utility theory. CERCLA guidance (Section 121(b), and NCP Section 300.430(e)) identifies seven evaluation criteria to be used in selecting a preferred remedial alternative. These seven criteria were broken down into more specific technical factors related to the set of alternatives under review (in accordance with U.S. EPA guidance); a total of 19 technical factors was assessed for each alternative. A panel of chemical and environmental engineers and an industrial hygienist assigned technical scores to each factor for each alternative. Weights (importance values) for each of the 19 factors were assigned by the technical panel. Technical factor scores were then multiplied by the weights to yield weighted factor scores and these scores

were summed to yield an overall score for each alternative. The alternatives were then ranked in accordance with the scores.

Sensitivity studies were done on the ranking by varying the weights (importance values) for the 19 ranking factors. These studies showed how the rank order would change if some factors were considered to be more important and others less important. This approach was used to model many hypothetical points of view, such as a point of view that emphasized protection of nearby residents over all other factors, or another point of view that emphasized all factors related to short-term or long-term risk and deemphasized factors related to cost. The sensitivity studies were used to identify a set of weights and a corresponding rank order that was reasonable and realistic and could be shared by many points of view. This rank order was recommended. The top-ranking alternative in this rank order is the preferred alternative.

The preferred rank order recommended in the treatment assessment study is

- Submerged quench incineration, on-site
- Wet air oxidation, on-site
- Wet air oxidation with PACT, on-site
- Electric melter furnace, on-site
- Solidification, on-site

5.0 CHRONOLOGY OF EVENTS

The significant events leading to the decision to remediate the Basin F liquids as described in Section 6.0 of this report are presented below.

Date	Event
May 1986	Department of the Army, Shell Oil Company, and the U.S. EPA, Region VIII agreed that an accelerated remediation be undertaken pursuant to CERCLA to contain the liquids and contaminated soils in and under Basin F.
June 1987	On June 5, 1987 the United States, Shell, and the State filed a report to the Court which included a 'Consensus list of Interim Response Actions.' Basin F liquid, sludges, and solids removal was identified as one of the IRAs which the United States, Shell and the State agreed to implement.
February 1988	Proposed Consent Decree lodged in the case of U.S. vs. Shell Oil Company with the U.S. District Court in Denver, Colorado.
March 1988	The first Interim Response Action (IRA-1) for Basin F liquid, sludges, and soils remediation was begun. Basin F liquid were transferred to three storage tanks and to a double-lined covered pond, Pond A. The tanks are lined with high-density polyethylene (HDPE) to provide additional corrosion protection. A double-lined waste storage pile was constructed within the former Basin F area.

Transfer of Basin F Liquid to tanks and the surface impoundment for interim storage was completed in December 1988. Approximately 4 million gallons of liquid are stored in the tank farm and 4.5 million gallons in Pond A.

June 1988 — After revision following public comments, a modified Proposed Consent Decree was lodged with the Court.

September 1988 — The Army completed contracting for a treatment assessment report, decision document, pilot-testing if necessary, and a final design package for Basin F Liquid Disposal.

December 1988 — Draft Task Plan prepared by the Army was distributed to Shell Oil Company, U.S. EPA, Colorado Department of Health and other organizations for review and comment.

February 1989 — The United States, represented by the Environmental Protection Agency, the Army, The Department of Health and Human Services, the Department of Interior, and the Department of Justice, and Shell Oil Company enter into a Federal Facility Agreement concerning the Rocky Mountain Arsenal. The Army and Shell Oil Company agreed to share certain costs of the remediation to be developed and performed under the oversight of the U.S. EPA, with opportunities for participation by the State of Colorado. The Federal Facility Agreement specified thirteen Interim Response Actions determined to be necessary and appropriate. Basin F Liquids, Sludges, and Soils Remediation is one of the thirteen IRAs. The time frame for completion of the Basin F Liquid IRA was set by the Technical Program Plan at a

	maximum of five years from May, 1988, based on the design life of the tanks.
March 1989	Final Task Plan and Appendices A through C were issued by the Army, describing the approach to selecting and designing the final treatment process for Basin F liquid.
20 July 1989	Public meeting held to describe the Basin F Liquids IRA and the Federal Facility Agreement at Hanson Elementary School, 7133 East 73rd Ave., Commerce City.
17 & 18 October 1989	Briefings held for elected officials, State and Federal agency personnel, and the Denver-area press on the Treatment Assessment Report.
18 October 1989	Draft Treatment Assessment Report issued by the Army distributed to Shell Oil Company, U.S. EPA, Colorado Department of Health and other organizations for review and comment.
19 October 1989	Public meeting held to explain findings of Draft Treatment Assessment Report at Hanson Elementary School.
4 November 1989	Public community workshop held to explain findings of Draft Treatment Assessment Report and solicit public comment. Invitations extended to members of the community identified by a phone canvass and signups at previous public meetings.
December 1989	Final Treatment Assessment Report issued describing the preferred alternative for treatment of Basin F liquid.

December 1989	Proposed Decision Document for Basin F Liquid Disposal prepared by the Army and distributed to Shell Oil Co., U.S. EPA, Colorado Department of Health, and other organizations for review and comment.
11 January 1990	Public meeting to present contents of the Proposed Decision Document at Hanson Elementary School.
January 1990	Comments received on Proposed Decision Document for Basin F Liquid Disposal. Comment period closed on 29 January 1990.
April 1990	Draft Final Decision Document for Basin F Liquid Treatment issued.
May 1990	Final Decision Document for Basin F Liquid Treatment issued.

6.0 SUMMARY OF THE INTERIM RESPONSE ACTION

Implementation of a Submerged Quench Incineration* system to treat Basin F liquid is the preferred alternative selected for this Interim Response Action. The Submerged Quench Incineration system will be built on Arsenal property at a site to be selected in the upcoming design phase. The treatment site will be selected after consideration of any potential health risks to residents of neighborhoods that are adjacent to the Arsenal.

This alternative can be easily implemented because it will use commercially available treatment technology that has been demonstrated on Basin F liquid, and which is widely used by industry for treatment of wastes similar to Basin F liquid. Other factors that contribute to tne ease of implementation are:

- The on-site location eliminates the need to transport untreated Basin F liquid off the Arsenal property. The conveyance system from interim storage to the treatment plant will be small in scale, free from complicated transfer operations, easy to control and monitor, and will present lower risks of accidents or spills than longer distance transport.

- The selection of an on-site treatment alternative allows the IRA to be implemented in a timely and cost effective manner. CERCLA and the FFA require that the facility attain to the maximum extent practicable, Applicable or Relevant and Appropriate Requirements. The CERCLA process avoids the delay normally required related to permitting (often as long as three to five years) and allows the

*Submerged Quench Incineration refers specifically to the T-Thermal Sub-X® Liqui-Datur® incinerator, which is only manufactured in the U.S. by T-Thermal, Inc., and cross-licensed by Nittetu Chemical Engineering, Limited.

on-site treatment alternative to be implemented within the agreed-upon timeframe for this IRA.

- A treatment evaluation test has already been conducted using a Submerged Quench Incinerator to destroy Basin F liquid, at a scale of operation that minimizes the need for subsequent pilot tests to develop scale-up design data.

- The chosen alternative, Submerged Quench Incineration, will reduce the volume of liquid by 75 percent and will produce a dried salt residual with a small metals content, that can be landfilled in an existing RCRA-permitted off-site landfill. The small volume (about 10,400 cubic yards) and low hazard level of these residuals can be accommodated in one of a number of landfills in the Inter-mountain region or the Midwest. The volume and type of residuals does not present the complexity of logistics and contracting problems associated with the residuals of other treatment alternatives.

The Army's decision for this IRA consists of three principal components:

- Selection of a treatment system and specification of the Treatment Facility

- Delineation of Implementation and Operating Objectives that describe how the facility will be developed and run

- Description of a Health and Safety Plan for the implementation of this IRA

6.1 THE TREATMENT FACILITY

The Submerged Quench Incineration system consists of a waste feed system, a treatment facility, environmental controls, and a residuals handling facility. Figure 6-1 is a conceptual schematic of a submerged quench incineration facility. This figure is an illustration of general treatment steps only and does not represent a selected configuration or equipment choice.

A closed waste feed system will deliver untreated Basin F liquid from the interim storage tanks and pond to the treatment facility. The feed system could consist of a pipeline, if the distance is very short, or could consist of a batch loading and transport system that would move a certain volume of waste periodically from interim storage to a short-term feed storage tank at the treatment facility. Liquid will not be exposed to ambient air during transfer. A feed system design which incorporates recirculation, suspension, jet mixers, or other means will be evaluated in the design phase. This will allow all residue that can be dissolved from cleaning the three tanks and surface pond now holding the liquid to be fed to the SQI.

The treatment facility will consist primarily of the incineration unit and air pollution abatement equipment. Liquid waste will be fed to the flame zone of the down-fired incinerator. Molten salts (residuals of the combustion) will flow down the sides of the incineration vessel and fall into a quench tank with water circulation. Combustion gases will be bubbled through the quench tank and then routed to the environmental controls, and the quench liquid (a brine) will be bled off and routed to the residuals handling facility.

The residuals handling facility is centered around a spray dryer, where brine blowdown from the incinerator quench tank will be dried to salt. This salt will then be routed to a closed handling system for dust and emissions control, and bulkloading or containerization in drums for eventual disposal in an off-site hazardous waste landfill.

The environmental controls will consist of air pollution abatement equipment to treat emissions to the level required. This equipment may consist of a mechanical scrubber for particulates in the gases from the quench tank, and a caustic (packed) scrubber as secondary treatment for the quench tank gases and primary treatment for the discharge air from the residuals handling facility.

The plant will be designed to treat 1000 gallons per hour of Basin F liquid. At this flow rate, it will take about 18 months to complete the destruction of the waste.

The steps to implement this alternative are

- Selection of a site for the treatment facility
- Preparation of a final design package and bid documents, in accordance with the FFA's staged design and review process
- Procurement of the treatment system and operations services, through the Army's established procurement system, or other system consistent with the FFA
- Construction of the treatment facility, including procurement of major equipment items, site preparation, construction of the main treatment facility, construction of ancillaries, and installation of monitoring equipment and stations
- Notification of the organizations, the State of Colorado and the state(s) where the potential receiving landfill(s) are located of intent to initiate shipping of product salts

- Preparation of a full-scale trial burn plan, for review by the EPA and others. In conjunction with this, development of monitoring plans and procedures, and emergency response plans and procedures

- System check-out and test of ancillary systems

- Conduct of a full-scale trial burn and associated monitoring. Adjustment of operating controls and procedures, establishment of necessary standards as described in Section 9.0 and if needed, supplemental design alterations

- Facility startup

- Operation of the facility for approximately 18 months to destroy the 8.5 million gallons of Basin F liquid

- Closure of the interim storage tanks and pond

- Decontamination and decommissioning of the treatment facility

- Certification of the destruction of Basin F liquid in accordance with the provisions of the FFA

6.2 IMPLEMENTATION AND OPERATION OBJECTIVES

The Army's decision for treatment of Basin F liquid includes several supplemental provisions for implementation and operation of a Submerged Quench Incineration treatment facility. These supplemental provisions concern how the treatment system will be developed and operated, to assure that government agency and private citizen concerns for safety and environmental protection are met. These provisions, expressed as implementation and operation objectives, were developed in direct and proportioned response to public agency and private citizen comments regarding the Treat-

ment Assessment Report. The following implementation and operation objectives are elements of the Army's decision for this IRA.

Design Measures

1. The Army will prepare a Public Health Risk Assessment based on measured emissions from the prior SQI treatment evaluation test burn performed at T-Thermal's testing facility in Conshohocken, Pennsylvania.

2. The Army will provide an operational and reliability survey report on the performance history of existing submerged quench incinerators in the U.S.

3. The Army will conduct a site selection study to select the exact location of the incinerator, as part of the design process. The location will be based on minimizing potential health risks associated with emissions and transportation, as well as consideration of several practical concerns such as access to utilities and traffic flow patterns.

4. The Army will conduct a special predesign test of the incinerator, planned specifically to collect and analyze data on optimizing waste nozzle atomization and metals control equipment performance. In order to address uncertainties that arose from prior test work, an analysis for dioxins and furans will be performed on both the feed liquid and air emissions from this test.

5. The Army will prepare a System Safety Hazard Analysis Report (SSHAR) of the incinerator during the design process. This report will be prepared in accordance with Federal guidance, and in addition will include a review of the operating histories and safety records of similar incinerators.

6. The incineration process will be designed to have operational and procedural controls.

Operational Safety Measures

7. The Army will invite the participation of independent monitoring professionals to be designated after consultation with Shell, the State and EPA, in the continuous monitoring program. The purpose of such independent oversight is to provide confirmation of operation within established limits.

8. As a safety measure, operational controls will regulate normal operation, restart operating mode, and will shut down the process in the event of upset conditions. These operational controls will be automatic and will have redundancy. As a further safety measure, procedural controls will be developed and employed; these are rules that the operators of the facility will follow when circumstances require. The operators of the treatment facility will be trained to operate the system and its supplemental controls in a manner that assures public safety and environmental protection. Operator training will include judgement guidelines by which operators can take into consideration the potential of added emissions from a shutdown/restart procedure. The treatment process will be shut down if weather conditions do not permit incinerator emissions to meet standards or operating requirements.

9. The Army will prepare an Emergency Response Plan for incinerator operation. This plan will be provided in the form of a supplement to the existing Arsenal-wide plan that was developed with local officals and the Division of Disaster Emergency Services. The plan will include procedures for emergency notification of area authorities should an upset condition occur. Initiation of new or

additional emergency response procedures associated with the incinerator will be addressed in the design of operational and procedural controls. The plan will be developed in consultation with local government authorities. The Army will assist local authorities in developing emergency response capabilities through training and consultation on procedures. The plan will also provide a point of contact and telephone number for residents to call in for information.

10. The Army will prepare an Emergency Response Plan for transportation of treatment residuals from RMA to off-site locations and transportation of process chemicals onto RMA.

11. The Army will operate the incinerator to attain the emission standards for regulated contaminants or pollutants, and will also establish operating goals for selected non-regulated contaminants or pollutants, subject to the concurrence of EPA, as described in Section 9.0. If the air emissions are above established operating limits, the process will be shut down and will not be operated until proper adjustments, or, if necessary, equipment modifications, can be made.

12. The Army will provide for continuous monitoring of the incinerator to assure operation within the established limits. Final monitoring standards will be developed after the trial burn is completed, in accordance with the procedures described in Section 9.0. If the network of ambient and process monitoring equipment indicates that established operating emissions limits are exceeded, the process will be shut down and will not be operated until proper adjustments, or, if necessary, equipment modifications, can be made.

13. The Army will monitor the emission of Products of Incomplete Combustion (PICs) through the use of accumulative samples, to be analyzed periodically for selected compounds. The set of compounds and the frequency of analysis will be developed as reflected in Section 9.2.2. Once the standards are developed, after the trial burn a letter formally enumerating these as additional ARARs would be sent to organizations and the State as an amendment to the ARARs section of the Decision Document.

Community Relations Measure

14. The Army will install and operate a permanent telephone system to respond to citizen questions and concerns about all aspects of RMA cleanup, and will maintain a log of all communications in the Joint Administrative Record and Document Facility (JARDF).

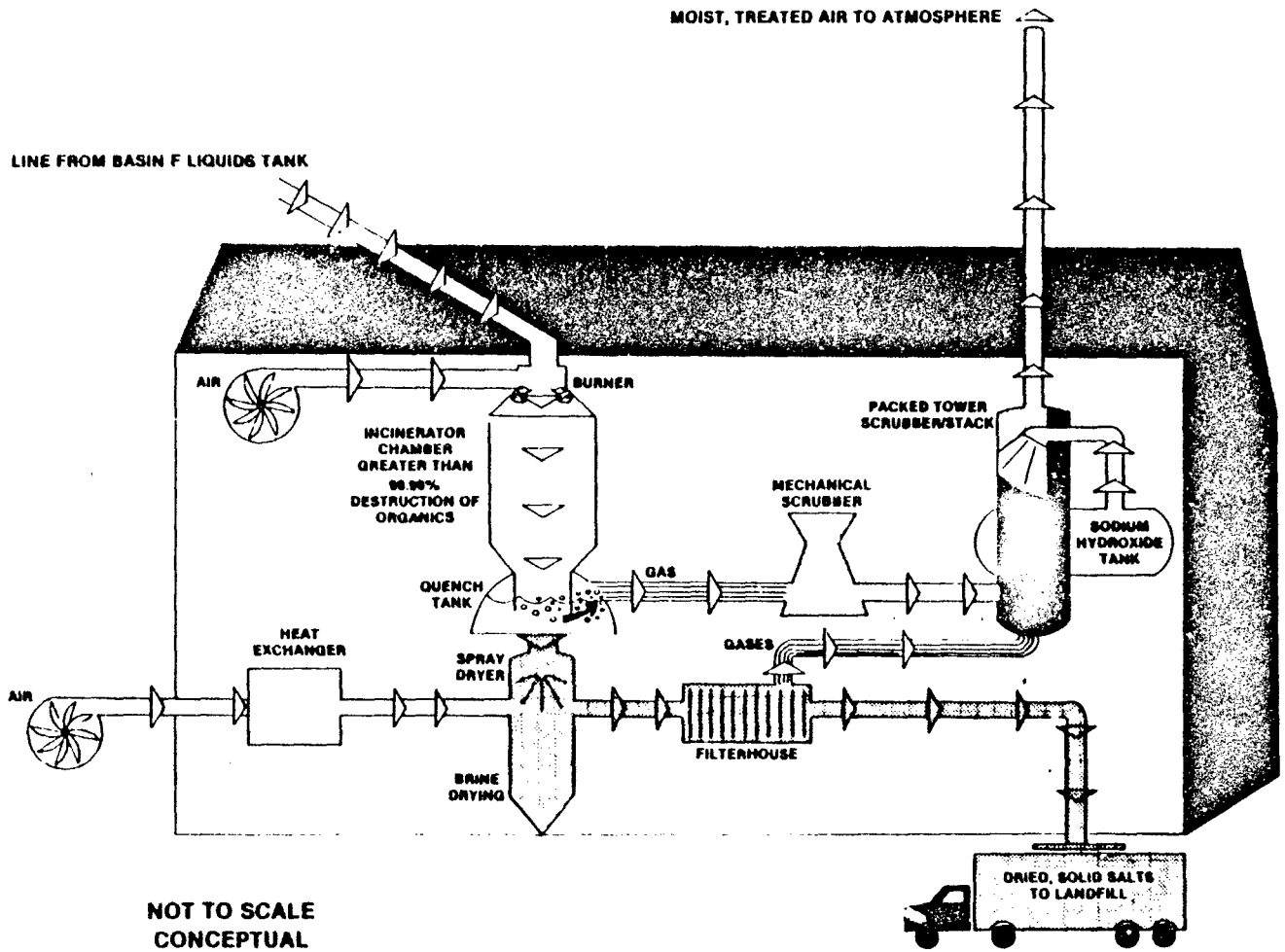
Shutdown Measure

15. Following completion of the Basin F Liquid IRA, the incinerator will be shut down, decontaminated, and decommissioned under the closure provisions described in Section 9.0. The incinerator will not be used for any non-RMA wastes, and use of the incinerator for other RMA wastes will not be pursued unless a formal treatment assessment remedy selection process with full public involvement has been completed for the proposed subsequent use.

6.3 HEALTH AND SAFETY PLAN

A Health and Safety Plan will be developed for the prevention of occupational injuries and illnesses during sampling, testing, monitoring, operation, and in decomissioning activities at the Basin F liquid IRA treatment facilities. This plan will address Federal requirements as well as health and safety requirements of Army contractors and their authorized

subcontractors. Compliance with this plan will be compulsory and the contractors will be responsible for self-enforcement. Contractors will be subject to inspection to verify compliance. The Health and Safety Plan will be developed taking into consideration known hazards as well as potential risks. To aid in the preparation of this plan, a System Safety Hazard Analysis will be performed in conjunction with the design process for the treatment facility. In addition, during the testing, startup, and operating modes, comprehensive environmental monitoring will be done to assure that the facility is operating within the design specifications. The Health and Safety Plan will include specifications for training, individual protective equipment, and emergency response procedures, and will include provisions for audits. To assure the safety of site workers during emergency shutdown conditions, an emergency procedure will be developed in accordance with Occupational Safety and Health Administration (OSHA) regulations for safe shutdown of the treatment facility. The Health and Safety Plan will be developed for inclusion in the Implementation Plan.



SUBMERGED QUENCH INCINERATION WITH SPRAY DRYING

Job No. : 22206A
Prepared by: S.L.J.
Date: 12/5/89

CONCEPTUAL DESIGN OF SUBMERGED QUENCH INCINERATION WITH SPRAY DRYING

FIG. 6-1

Woodward-Clyde Consultants

7.0 IRA PROCESS

With respect to this Interim Response Action for the remediation of Basin F Liquid at Rocky Mountain Arsenal (RMA), the IRA process is as follows:

1. The Army issued the Proposed Decision Document for the IRA for the remediation of Basin F liquid on 28 December 1989 for a 30-day public comment period. During the 30-day comment period, the Army held one public meeting on 11 January 1990 addressing the IRA decision. The Proposed Decision Document is supported by an administrative record.

2. The Army issued the Draft Final Decision Document on 6 April 1990 for the IRA for remediation of Basin F liquid, to the Organizations, Department of Interior (DOI), and the State. This Decision Document included a written response to comments and concerns raised during the public comment period.

3. Within 20 days of after the issuance of a draft final IRA Decision Document for the remediation of Basin F Liquid, an organization (including the State if it has agreed to be bound by the Dispute Resolution process, as required by the Federal Facility Agreement) may invoke Dispute Resolution.

4. Dispute Resolution was not invoked. The Army is issuing this final IRA Decision Document in May 1990 to the other Organizations, and the State. The Army is notifying the public of the availability of the final IRA Decision Document with the supporting administrative record.

5. Following issuance of the final IRA Decision Document, the Army shall be the Lead Party responsible for designing and implementing the IRA in conformance with the Decision Document. The Army shall issue a draft IRA Implementation Document to the Department of the Interior, the State, and the other organizations for review and comment. The Draft Implementation Document shall include final drawings and specifications, final design analyses, a cost estimate, and IRA deadlines for implementation of the IRA.

6. If any Organization (including the State), believes that the IRA is being designed or implemented in a manner that will not meet the objectives for the IRA set forth in the final IRA Decision Document, or is otherwise not being properly implemented, it may so advise the others and shall recommend how the IRA should be properly designed or implemented. Any organization (including the State, if it has agreed to be bound by the process of Dispute Resolution, as required by the Federal Facility Agreement) may invoke Dispute Resolution to resolve the disagreement.

7. As Lead Party for the design and implementation of this IRA, the Army will issue the Final Implementation Document, as described above, and will be responsible for implementing the IRA in accordance with the IRA Implementation Document.

8.0 COMMUNITY RELATIONS PROGRAM

In an effort that paralleled the preparation of the Treatment Assessment report for the Basin F Liquid IRA, a community relations program was conducted. The objectives of the community relations program for this IRA are to:

- Inform the public on key issues and decisions at RMA
- Provide opportunities for informed comment from the public
- Increase credibility and trust between the Army and the public

To guide the community relations program, a community relations plan was prepared. This plan is available in the RMA Joint Administrative Record and Document Facility (JARDF) at the main gate, as well as in Denver-area libraries and public document repositories. The Community Relations Plan describes community relations activities and community involvement issues for all RMA Interim Response Actions.

Under the community relations plan a number of methods were used to contact and inform the public; those efforts were as follows:

Community Interviews. Community leaders and representatives of citizen interest groups (Such as Citizens Against Contamination) were interviewed to identify key concern regarding the Basin F Liquid IRA. These interviews took the form of meetings of the RMA Technical Review Committee and a public meeting at Hanson Elementary School on 20 July 1989.

Media Briefings. On 18 October 1989, a special briefing on the Basin F Liquid, IRA Treatment Assessment Report was given to the Denver Press Corps at the Denver Press Club. The briefing included a question and answer session, and the briefing was accorded reasonably complete coverage by print and broadcast media over the next two days.

Briefings of Community Leaders and Elected Officials. On 17 October 1989, a special briefing on the Basin F Liquid IRA Treatment assessment study was given to elected officials of Commerce City and Adams and Denver counties. On November 7, 1989 a briefing was given to the Commerce City Business and Professional Association, targeting key community leaders of Commerce City and Adams County.

Public Workshop. On 4 November 1989 a workshop was held at the Stapleton Plaza Hotel in Denver. Twenty-four members of the public participated, and numerous other representatives of the EPA and Colorado Department of Health were on hand to observe. The workshop included detailed presentations of treatment alternatives for Basin F liquid, an interactive alternative ranking demonstration, extensive question and answer sessions, small group sessions to specify concerns, and a closing discussion of small group findings chaired by the Program Manager for Rocky Mountain Arsenal.

Public Comment Period and Public Meeting. The public comment period on the Basin F Liquid IRA proposed Decision Document extended 30 days from the release of the proposed Decision Document. A public meeting to present the proposed Decision Document and solicit public comments was held on 11 January 1990.

Written Response to Comments. The written response to comments received on the Draft Treatment Assessment Report, as well as comments and concerns raised in the public workshop, is included as Appendix A to the Final Treatment Assessment Report. The written response to comments received during the public comment period is presented as Appendix A to the Final Decision Document.

Information Repositories. A Joint Administrative Record and Document Facility (JARDF) has been established at the main gate of the Arsenal, and is open to the public. This facility contains the administrative record for the Basin F Liquid IRA. In addition, copies of the assessment and

decision documents for this IRA have been placed in public libraries and other public document repositories in the Denver area. Information on the location and availability of written materials concerning the Basin F Liquid IRA can be obtained by calling the RMA Public Affairs office at (303) 289-0143.

Tours of the Arsenal. The Army has offered to arrange for tours of RMA by interested citizens. Arrangements for these tours will be made in response to expressed citizen interest.

Special Topic Written Materials. A special briefing kit was prepared by the Army and presented to all attendees of all briefings, public meetings and the public workshop. The briefing kit included a description of public involvement opportunities at hazardous waste sites like the Arsenal (an EPA document), a brief history of RMA, a "white paper" summarizing the treatment assessment study, fact sheets and drawings of the Basin F Liquid treatment alternatives that were evaluated in detail, and fact sheets on four key technical topics: chemicals found in Basin F Liquid, the remedy selection process, the risk assessment performed on the treatment alternatives, and the Federal Facility Agreement. This kit was also made available to the Denver-area press.

Of all of the community relations activities conducted to date for the Basin F Liquid IRA, the public workshop on 4 November 1989 provided the main opportunity for members of the public to express their concerns and ask questions on a broad spectrum of technical and policy issues. All concerns and questions raised at the workshop were recorded, and the Army made a commitment to consider these concerns in framing a decision for the Basin F Liquid IRA, as well as to provide appropriate responses. Table 8-1 is a summary listing of these concerns by major topic and a description of how the Army has responded to each concern.

Two forms of response are included in Table 8-1: written response to workshop comments, and active response in the form of a "decision element". Written responses are included in Appendix A of the Treatment Assessment Report. A decision element is an addition or qualification or supplement to the basic selection of Submerged Quench Incineration as the preferred remedial alternative. These decision elements include Army commitments to add design elements to the incineration system, or prepare special plans or studies, or adopt standards, or engage in special activities, to respond to the concern raised by the public.

The objective of Table 8-1 is to demonstrate how these decision elements are in direct response to public concerns expressed at the workshop; in other words, the table shows how public input has been considered in the IRA decision process.

The decision elements listed on Table 8-1 are numbered; the numbers correspond to numbered paragraphs in Chapter 6.0, Section 6.2 (Implementation and Operating Objectives), in which the Basin F Liquid remedial decision is described.

TABLE 8-1

EXPRESSED CONCERNS AND FORM OF RESPONSE

Major Topic	Specific Concern	Form of Response*
Treatment Process in General		
	• Odor	Written Response
	• Operational controls, re: weather, upset conditions	Decision Element (6,8)
	• Location of facility	Decision Element (3)
	• Off-site disposal of residuals or wastes	Written Response
	• How the process works	Written Response
	• Historical reliability of the SQI process	Decision Document (2)
Incineration		
	• Characteristics of submerged quench incinerator	Written Response
	• Operational controls re: weather, upset conditions	Decision Elements (6,8,11)
	• Products of incomplete combustion (PICs)	Decision Elements (11,13)
	• Safety of SQI technology	Decision Elements (5,9)
	• Use of incinerator after Basin F IRA	Decision Element (15)
	• Screening and selection of incinerators	Written Response
Health Effects		
	• Transportation risks	Decision Element (10)
	• Treatment process risks	Decision Elements (1,6,7,8,12,13)
	• Long-term effects	Written Response
Trust/Credibility		
	• Objectivity and quality of monitoring	Decision Elements (7,11,12)
	• Existence and enforceability of standards for many emission compounds of concern	Decision Elements (11,13)
	• Army's commitment to safety	Decision Elements (5,6,8,9,10,12)
	• Opportunity for independent oversight	Decision Element (7)
Ranking		
	• Details on ranking	Written Response
	• Constraints to study	Written Response
Public Involvement		
	• Expand opportunities for interaction	Written Response
	• Permanent hotline and response log	Decision Element (14)
Regulatory Process		
	• Scope of IRA in relation to other cleanup activities at RMA	Written Response

* Written response to expressed concerns occurs in Appendix A to the Treatment Assessment Report. Concerns from the public workshop are grouped separately from other concerns and comments submitted by government agencies and parties to the federal facility agreement.

"Decision Element" means that the Army's response to the expressed concern has been made a part of the proposed decision described in Section 6.0 of this decision document. The decision element numbers (in parentheses) shown here correspond to the numbered "Implementation and Operating Objectives" presented in Section 6.2 of this document.

9.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

9.1 INTRODUCTION

The Basin F Liquid treatment Interim Response Action (IRA) is designed to accomplish final disposal of the Basin F liquids currently stored at the Rocky Mountain Arsenal. The components of this liquid are unique. Every attempt has been made to determine current promulgated regulatory standards that may be applicable or relevant and appropriate to this IRA treatment proposal. The treatment process will not result in the release of any liquids to surface or ground water. The treatment process will result in air emissions and solid waste residues which are intended to be disposed of off-site.

9.2 AMBIENT OR CHEMICAL-SPECIFIC ARARs

Ambient or chemical-specific requirements set concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. Such ARARs either set protective clean-up levels for the chemicals of concern in the designated media or indicate an appropriate level of discharge.

The objectives of this IRA are discussed in the Treatment Assessment Report. This IRA will be implemented prior to the final remediation to be undertaken in the context of the Onpost Operable Unit ROD. The list of specific contaminants has been compiled based upon treatability test data and represents those contaminants likely to be contained in the liquid. The media of concern here is the liquid to be treated by the selected IRA treatment technology. This selected IRA treatment system will not discharge liquids to either ground water or surface water. The selected treatment system will result in air emissions and solid residues which will require proper disposal. The Army anticipates that disposal of solid residues will take place off-site.

These ARARs address the selected alternative for this IRA, submerged quench incineration conducted on-site with off-site disposal of solid residues. Most air standards are not cnemical-specific limitations, but are in the form of technology requirements or similar action-specific limitations.

9.2.1 Air Emissions

The standards contained at 40 CFR Part 50 were reviewed and determined to be neither applicable nor relevant and appropriate to this IRA as specific limitations to be applied to emissions. These standards apply to Air Quality Control Regions, which are markedly dissimilar from the area that may be affected by the operation of an incinerator during treatment by this IRA system. Air Quality Control Regions are large areas encompassing a wide variety of industrial-type facilities. Standards for these regions are not applied to individual emissions sources such as smokestacks and automobile tailpipes, but to the region as an entirety. Therefore the Army will not apply these numerical standards to the specific emissions from the IRA treatment system. However, it is important that the IRA treatment system not have an adverse impact on these air quality standards for the Air Quality Control Region in which it is located. Therefore, while ambient air standards themselves are not appropriate to apply directly to this treatment system, individual operating standards will be developed which will avoid adverse impacts on the ambient air quality in the region or causing nonattainment of any ambient air standard. This will be accomplished by the standard setting process discussed below. This process will address not only compounds for which there are ambient air standards but other possible air emissions. These standards are appropriately developed further into the process based upon detailed testing of the specific equipment intended to be used and the specific material to be destroyed using a process similar to that reflected in 40 CFR Part 270. The standards developed by that process will be chemical-specific ARARs for the operation of the IRA treatment system.

Colorado Air Pollution Control Regulation No. 1 was similarly reviewed and determined to contain no chemical-specific requirements which are either applicable or relevant and appropriate to apply to this IRA treatment system, except for those pertaining to sulfur dioxide emissions contained in Section VI which are considered relevant and appropriate to apply to this IRA. Specific provisions of this section apply to specific types of equipment. The actual equipment selected for use in this IRA will determine which provisions of this section are relevant and appropriate concerning the operation of that specific equipment.

The standards contained at 40 CFR Part 61, the National Emission Standards for Hazardous Air Pollutants (NESHAPS), were reviewed and determined not to be applicable to the operation of this IRA system. These standards apply to specific sources of the listed pollutants. For example, Subpart E of 40 CFR Part 61 applies to sources which process mercury ore to recover mercury and other specific processes, Subpart J of this Part applies to sources which include equipment which contains or contacts a fluid that is at least 10 percent benzene by weight and the arsenic provisions of Subparts N, O and P of this part apply to very specific plants, smelters or facilities. Since the operations contemplated by this IRA treatment system are extremely dissimilar from the processes described in 40 CFR Part 61 and the liquid concerned is also extremely dissimilar to the liquid described in Subpart J of 40 CFR Part 61, these standards were not considered to be applicable or relevant and appropriate to apply to this IRA treatment system. However, Subpart V is considered relevant and appropriate to apply to this IRA. Subpart E, concerning mercury emissions, was considered potentially relevant and appropriate, but was not selected as an ARAR since Colorado Air Pollution Control Regulation No. 8 more directly addressed mercury emissions from sources similar to the proposed IRA treatment system. Subpart V was considered relevant and appropriate to apply to this IRA because it is concerned with fugitive emissions from equipment similar to that contemplated by this IRA treatment system.

Colorado Air Pollution Control Regulation No. 8 was also reviewed to determine whether it contained any limitations more stringent than the NESHAPS discussed above. Similarly to the NESHAPS requirements, this regulation is not considered applicable to this IRA because it applies to specific processes substantially dissimilar to those contemplated by this IRA. This regulation contains a provision for mercury emissions from sources using mercury in any form. Since a very low level of mercury is present in Basin F liquid, the mercury standard of 2300 grams/five pounds per day contained in this regulation is considered relevant and appropriate to apply to emissions from this treatment system.

The regulations at 40 CFR Part 60, concerning standards of performance for new stationary sources (NSPS), were reviewed and determined not to be applicable to the operation of any treatment system contemplated by this IRA. As with those regulations contained in 40 CFR Part 61, these regulations apply to specific processes which result in the emissions regulated by the NSPS. For example, Subpart E concerning incinerators applies to incinerators which burn solid waste containing at least 50 percent municipal type waste, Subparts F, G, H, and I apply to specific plants, and other subparts apply to specific manufacturing processes. A review of these subparts indicated that none concerned a process sufficiently similar to the treatment contemplated by this IRA so that they were relevant and appropriate to apply to the treatment system contemplated in this IRA.

The Colorado NSPS contained in the Code of Colorado Regulations, 5 C.C.R. Part 8, Regulation No. 6, were also reviewed and determined to be neither applicable nor relevant and appropriate to apply in the context of this IRA, except as noted below. As with the federal NSPS, these regulations address specific processes, production facilities and similar operations which are extremely dissimilar to the treatment system contemplated by this IRA. The particulate standard was not more stringent than the federal

standard identified so was not selected as an ARAR. The opacity standard was considered as an action-specific ARAR.

9.2.2 Standard Setting Process For Air Emissions

As noted above, it is very important that specific standards be developed for this IRA treatment system. The Army has determined that the most efficient and technically sound manner to accomplish this standard setting is by using a process which closely follows that contained in 40 CFR Part 270, which is used for establishing specific standards for specific air sources, except that no permit will be issued. The process, as described below and identified in 40 CFR Part 270, is considered relevant and appropriate to apply to this IRA.

Pursuant to 40 CFR §270.62 a trial burn plan will be submitted to EPA with copies provided to the State, Shell, Department of Interior and Agency for Toxic Substances and Disease Registry for their review and comment. This trial burn plan will include an analysis of the liquid to be incinerated, a detailed description of the incinerator, a description of sampling and monitoring procedures, a test protocol, test schedule, description of emissions control equipment to be used and the planned operating conditions. Procedures will be included which describe stopping the waste feed, shutting down the incinerator and controlling emissions in the event of an equipment malfunction. Since this provision is an ARAR (except for the permitting requirements), and consistent with the EPA role regarding federal facilities as established by CERCLA and Executive Order 12,580, the trial burn plan and subsequent standard setting actions will be subject to EPA concurrence prior to the Army's continuing with the implementation of this IRA.

After the trial burn is conducted, final emissions limitations will be established with the concurrence of EPA. The provisions of 40 CFR §264.343 establish performance standards based on destruction and removal

efficiencies of 99.99% or 99.9999% for dioxin or dibenzofuran wastes. This regulation also establishes standards of 0.08 grains per dry standard cubic foot for emissions of particulates and 1.8 kilograms per hour for emissions of hydrogen chloride. The provisions of 40 CFR §264.345 require that acceptable operating limits be established for carbon monoxide, waste feed rate and combustion temperature. Other operating requirements to ensure the performance standards are met, and any necessary standards which may be required for other emissions such as metals, may also be established pursuant to this section. These standards will be developed during this trial burn process and be applicable to the operations of this IRA treatment system. Other operating requirements are discussed in the Action-Specific ARARs section concerning incinerator operations.

Consistent with EPA guidance that CERCLA remedial actions be protective of human health and the environment, the Army has established a design and operating requirement for this system such that there will be created no cumulative risk higher than 1 X 10E-6 (one in one million) of excess cancer incidence, or hazard index greater than 1 for noncarcinogenic compounds, in the nearest exposed population, whether on or off the Arsenal. The treatment system workers, who are protected by the worker protection provisions, are not included in the definition of exposed population. Analysis will be based on a calculated exposure of two years duration which assumes 24 hour daily exposure. While the Army is confident this design and operating requirement can be attained by the selected technology, if final design and testing indicate difficulty in attaining this design and operating requirement, the Army will consult with EPA, Shell, the Agency for Toxic Substances and Disease Registry, the Department of Interior and the Colorado Department of Health concerning modifications necessary for a treatment system before proceeding further in the IRA process. After consultations, if it appears necessary to depart from the design and operating goal in a manner which is significant in terms of its effect on human health or protection of the environment, the Army will issue an amended Decision Document for review and comment consistent with the

procedures contained in paragraphs 22.9 - 22.16 of the Federal Facility Agreement.

A "to be considered" (TBC) for this standard setting is the EPA six volume Water Incineration Guidance Series, including:

Volume I - Guidance Manual for Hazardous Waste Incinerator Permits

Volume II - Guidance on Setting Permit Conditions and Reporting Trial Burn Results

Volume III - Hazardous Waste Incineration Guidance Manual

Volume IV - Guidance on Metals and Hydrogen Chloride Controls for Hazardous Waste Incinerators

Volume V - Guidance on PIC Control for Hazardous Waste Incinerators

Volume VI - Proposed Methods for Measurements for CO, O2, THC, HCl, and Metals at Hazardous Waste Incinerators

The Army does not now anticipate that the IRA treatment system will be a major stationary source or have a significant emissions rate as defined by either State or federal regulations. However, this can not be definitively determined until later in the IRA process, particularly after the trial burn is conducted. If the IRA treatment system is determined to constitute a major source after testing is complete, the regulatory provisions relevant to such sources will be reviewed to determine any additional ARARs.

9.3 LOCATION-SPECIFIC ARARs

Location-specific requirements set restrictions on activities, depending on the characteristics of the site or the immediate environment, and function like action-specific requirements. Alternative remedial actions may be restricted or precluded, depending on the location or characteristics of the site and the requirements that apply to it.

Paragraph 44.2 of the Federal Facility Agreement provides that "wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act (16 U.S.C. §1531 et seq.), migratory birds to the extent required by the Migratory Bird Treaty Act (16 U.S.C. §703 et seq.), and bald eagles to the extent required by the Bald Eagle Protection Act, 16 U.S.C. §688 et seq."

While this provision is not an ARAR, the statutes themselves constitute ARARs and will be complied with for purposes of this IRA. Although final siting of this system will be addressed during the design phase of this IRA, based on where this treatment system is likely to be located the Army believes that this IRA will have no adverse impact on any endangered species or migratory birds or on the protection of wildlife habitats. Coordination will be maintained with the U.S. Fish and Wildlife Service to ensure that no such adverse impact arises from implementation of this IRA.

The provisions of 40 CFR §6.302(a) and (b) regarding construction that would have an adverse impact on wetlands or be within a flood plain are considered relevant and appropriate to apply in the context of this IRA. Based upon where this system will be located the Army believes that there will be no adverse impact on wetlands from the construction of this system. Coordination will be maintained with the U.S. Fish and Wildlife Service to ensure that any such adverse impacts are avoided or mitigated.

The regulations at 40 CFR 230 were reviewed and determined not to be applicable within the context of this IRA because no discharge of dredged or fill material into waters of the United States is contemplated. Because these regulations address only the disposal of such materials into waters of the United States, which is not contemplated, they are not considered to be relevant and appropriate to apply in the context of this IRA.

9.4 ACTION-SPECIFIC ARARs

9.4.1 Description

Performance, design, or other action-specific requirements set controls or restrictions on activities related to the management of hazardous substances, pollutants, or contaminants. These action-specific requirements may specify particular performance levels, actions, or technologies as well as specific levels (or a methodology for setting specific levels) for discharged or residual chemicals.

9.4.2 Construction of Treatment System

9.4.2.1 Air Emissions

In the context of this IRA, there is only a very remote chance of any release of volatiles or semivolatiles and, even if such a release did occur, it would only be intermittent and of very brief duration (because the activity that produced the release would be stopped and modified appropriately if a significant air emission was detected by the contractor's air monitoring specialist). This IRA does not contemplate construction of underground facilities, therefore almost eliminating any chance of air emissions during construction. The construction of above ground facilities, including any decontamination pads, is not expected to involve excavation at depths which could result in release of volatile organics, making any ambient air quality standards neither relevant nor appropriate to this construction activity.

The site-specific Health and Safety Plan will adequately address these concerns. This plan to be developed for use in this IRA will detail operational modifications to be implemented in the event monitoring detects specific levels of such emissions. This plan is developed after the actual construction site has been chosen and is based upon site-specific information. It will be available for review later in the IRA process.

The National Emissions Standards for Hazardous Air Pollutants (NESHAPS) were evaluated to determine whether they were applicable or relevant and appropriate to apply in the context of construction of this IRA. These standards were not considered applicable because they apply to stationary sources of these pollutants, not to construction activity. They were not considered relevant and appropriate because they were developed for manufacturing processes, which are significantly dissimilar to the short-term construction activity contemplated by this IRA.

The provisions of 40 CFR 50.6 will be considered relevant and appropriate. This standard is not applicable because it addresses Air Quality Control Regions, which are areas significantly larger than and different from the area of concern in this IRA. Pursuant to this regulation, there will be no particulate matter transported by air from the site that is in excess of 75 micrograms per cubic meter (annual geometric mean) and 260 micrograms per cubic meter (maximum 24-hour concentration) will not be exceeded more than once per year.

As noted below, Colorado Air Pollution Control Regulations specifically address particulate emissions from construction activities (5CCR 1001) and the 20% opacity limitation contained therein is considered relevant and appropriate to apply to particulate emissions.

9.4.2.2 Worker Protection

The provision of 29 CFR §1910.120 are applicable to workers at the site because these provisions specifically address hazardous substance response operations under CERCLA. It should be noted that these activities are presently governed by the interim rule found at 29 CFR §1910.120 but that by the time IRA activity commences at the site, the final rule found at 54 FR 9294 (March 6, 1989) will be operative. (The final rule becomes effective on March 6, 1990.)

9.4.3 General Construction Activities

The following performance, design, or other action-specific State ARARs have been preliminarily identified by the Army as applicable to this portion of the IRA:

Colorado Air Pollution Control Commission Regulation No. 1, 5 CCR 1001-3, Part III(D)(2)(b), Construction Activities:

a. Applicability - Attainment and Nonattainment Areas

b. General Requirement

Any owner or operator engaged in clearing or leveling of land or owner or operator of land that has been cleared of greater than one (1) acre in nonattainment areas for which fugitive particulate emissions will be emitted shall be required to use all available and practical methods which are technologically feasible and economically reasonable in order to minimize such emissions, in accordance with the requirements of Section III.D. of this regulation.

c. Applicable Emission Limitation Guideline

Both the 20% opacity and the no off-property transport emission limitation guidelines shall apply to construction activities; except that with respect to sources or activities associated with construction for which there are separate requirements set forth in this regulation, the emission limitation guidelines there specified as applicable to such sources and activities shall be evaluated for compliance with the requirements of Section III.D. of this regulation. (Cross Reference: Subsections e. and f. of Section III.D.2 of this regulation).

d. Control Measures and Operating procedures

Control measures or operational procedures to be employed may include but are not necessarily limited to planting vegetation cover, providing synthetic cover, watering, chemical stabilization, furrows, compacting, minimizing disturbed area in the winter, wind breaks, and other methods or techniques.

Colorado Ambient Air Quality Standards, 5 CCR 1001-14, Air Quality Regulation A, Diesel-Powered Vehicle Emission Standards for Visible Pollutants:

a. No person shall emit or cause to be emitted into the atmosphere from any diesel-powered vehicle any air contaminant, for a period greater than 10 consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity, with the exception of Subpart B below.

b. No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated diesel-powered vehicle of over 8,500 lbs gross vehicle weight rating operated above 7,000 feet (mean sea level), any air contaminant for a period greater than 10 consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 50% opacity.

c. Diesel-powered vehicles exceeding these requirements shall be exempt for a period of 10 minutes, if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position.

d. This standard shall apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways.

Colorado Noise Abatement Statute, C.R.S. Section 25-12-103:

a. Each activity to which this article is applicable shall be conducted in a manner so that any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Sound levels of noise radiating from a property line at a distance of twenty-five feet or more therefrom in excess of the db(A) established for the following time periods and zones shall constitute prima facie evidence that such noise is a public nuisance:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in subsection (1) of this section may be increased by ten db(A) for a period of not to exceed fifteen minutes in any one-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five db(A) less than those listed in Subpart (a) of this section.

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements.

In substantive fulfillment of Colorado Air Pollution Control Commission Regulation No. 1, this IRA will employ the specified methods for minimizing emission from fuel burning equipment and construction activities. In substantive fulfillment of Colorado's Diesel-Powered Vehicle Emission Standards, no diesel motor vehicles associated with the construction shall be operated in a manner that will produce emissions in excess of those specified in these standards.

The noise levels pertinent for construction activity provided in C.R.S. Section 25-12-103 will be attained in accordance with this applicable Colorado statute.

9.4.4 Wetlands Implications

Through estimation of the general area where a system would be located, the Army does not believe that any wetlands could be adversely affected. However, until a final design is selected and a final siting decision made, it cannot be definitively determined that no impact on wetlands will

occur. If the final site selection and/or design results in an impact on wetlands, the Army will review the regulatory provisions concerning wetlands impact and other appropriate guidance, and will proceed in a manner consistent with those provisions. Coordination will be maintained with the U.S. Fish and Wildlife Service concerning any potential impacts on wetlands.

9.4.5 Land Disposal Restrictions and Removal of Soil

There are no action-specific ARARs that pertain to the excavation of soil during the construction of this treatment system.

EPA is currently developing guidance concerning the Land Disposal Restrictions (LDR). While guidance is limited, the Army has not determined that any waste subject to LDR will be present in any soils that may be excavated by construction of this IRA. Further guidance is expected to be completed prior to the implementation of this IRA and the Army will review such guidance as it is released. If it is determined that a waste subject to LDR is present, the Army will act in a manner consistent with EPA guidance then in effect for the management of such as the context of CERCLA cleanup actions.

Although removal of soil from the area where treatment system will be located is a TBC, not an ARAR, it will be performed in accordance with the procedures set forth in the Task No. 32 Technical Plan, Sampling Waste Handling (November 1987), and EPA's July 12, 1985, memorandum regarding "EPA Region VIII Procedure for Handling of Materials from Drilling, Trench Excavation and Decontamination during CERCLA RI/FS Operations at the Rocky Mountain Arsenal." In general, any soils generated by excavation during the course of this IRA, either at surface or subsurface, will be returned to the location from which they originated (i.e., last out, first in). Any materials remaining after completion of backfilling that are suspected of being contaminated (based on field screening techniques) will be properly

stored, sampled, analyzed, and ultimately disposed as CERCLA hazardous wastes, as appropriate.

For material determined to be hazardous waste, substantive RCRA provisions are applicable to their management. These substantive provisions include but are not limited to: 40 CFR Part 262 (Subpart C, Pre-Transport Requirements), 40 CFR part 263 (Transporter Standards), 40 CFR Part 264 (Subpart I, Container Storage) and any more stringent substantive State requirements for the management of hazardous wastes. The specific substantive standards applied will be determined by the factual circumstances of the accumulation, storage, or disposal techniques actually applied to any such material.

9.4.6 System Operations

9.4.6.1 Tanks

Subpart J of 40 CFR Part 264 is considered relevant and appropriate to apply in the context of this IRA to tanks which are used to store liquid prior to its treatment by the IRA treatment system.

9.4.6.2 Incinerator Operations

Certain action-specific requirements have been determined to be relevant and appropriate to apply in the context of this IRA to the operation of any incinerator. These requirements are:

The substantive requirements of 40 CFR Part 264, Subpart O, some of which concerning performance standards for an incinerator were previously discussed in the context of standard setting for chemical-specific ARARs. Also considered substantive are the requirements of 40 CFR §264.341(b) concerning waste analysis, 40 CFR §264.342 (except for the permit requirement), 40 CFR §264.343 (except for the permit requirement), 40 CFR

§264.344 (except for the permit requirement, which is duplicated by the standard setting process noted above), 40 CFR §264.345 (except for the permit requirement) which discusses operating requirements, 40 CFR §264.347 (except for the permit requirement) which establishes monitoring requirements which will be established through the standard setting process discussed above and 40 CFR §264.351 concerning closure. The treatment system will be operated in accordance with the final operating requirements established pursuant to this document. Other general operating requirements are considered relevant and appropriate to this IRA treatment system. These provisions are contained in 40 CFR Part 264, Subparts B, C and D. The substantive requirements of these Subparts are considered ARARs. These include the requirements (except permit requirements) of 40 CFR §§ 264.11, 264.13, 264.14, 264.15, 264.16, 264.17, 264.18, 264.31, 264.32, 264.33, 263.34, 264.35, 264.37, 264.51, 264.52, 264.53, 264.54, 264.55, and 264.56. Further requirements may be identified later in the design and implementation process as more specific information is developed.

The provisions of the Colorado NSPS, discussed above, in Section III which contain standards for opacity are considered relevant and appropriate to apply to operations of this treatment system. The standards for particulate matter contained in this regulation are not more stringent than the federal standard identified in the chemical-specific ARAR section, above.

The provisions of Colorado Air Pollution Control Regulation Number 1, specifically Section II (Smoke and Opacity) are considered relevant and appropriate to apply to operations of this treatment system.

The provisions of Colorado Air Pollution Control Regulation Number 2, concerning odor emissions, is considered relevant and appropriate to apply to the operations of this treatment system.

The Colorado Noise Abatement Statute, discussed above, is also applicable to incinerator operations.

9.4.6.3 Incinerator Residues

The specific requirements which may apply to the specific residues remaining from treatment of these liquids can not now be identified. After further treatability testing, when the specific contents of residues are known, specific disposal requirements can be identified. This section discusses general requirements based upon general characteristics. Any residues from incinerator operations, such as brine or salts, will be properly managed and disposed of. As discussed above, no liquid effluent from the treatment of liquids by this IRA treatment system will be discharged into surface water or ground water at the site. Any solids, such as salts, which remain after treatment and require disposal will be tested to determine whether they are hazardous wastes. If determined to be hazardous, they will be properly manifested as required by 40 CFR Part 262 for off-site disposal in an authorized facility. If determined to be non-hazardous they will be disposed of in an appropriate facility approved for the disposal of such non-hazardous materials. Transportation of any hazardous waste off-site will be in accordance with 40 CFR Part 263, which is applicable, and any more stringent State regulations concerning the off-site disposal of these residues. It is not anticipated that incinerator residues will be subject to the Land Disposal Restrictions (LDR) because of the expected low concentrations of any hazardous constituents which may remain after the incineration process. However, this is an area wherein EPA is developing new policies and it can not be definitively determined at this time if LDRs could affect the off-site disposal of these residues. Actual residue constituents from this process can not be definitively established until after the trial burn process. The Army will act consistent with the EPA policy applicable to the actual residue which will require disposal at the time disposal must be accomplished. Since it can not be definitively determined at this time what those specific

requirements will be, the Army recognizes that this issue will require review later in the IRA process.

9.4.7 Removal of Tanks and Ponds

After completion of the treatment of the Basin F liquids by this IRA, the Army intends to discontinue use of the tanks and ponds and remove those facilities after decontamination. This action will proceed in substantive compliance with the regulatory requirements for closure of such facilities. Major regulatory provisions are identified below, however these will be revisited later in the IRA process when operations near completion. The requirements identified below do not represent a comprehensive list of all requirements, as more specific details remain to be determined later in the IRA process.

The decontamination and removal of the liquid storage tanks will be in substantive compliance with the requirements of 40 CFR Sec. 264.197. Financial responsibility provisions of this section are not considered applicable. The decontamination and removal of the surface impoundments will be in substantive compliance with the requirements of 40 CFR Sec. 264.228. Subsections (a) and (b) of this section contain a detailed listing of substantive requirements for this action. The Army will proceed in substantive compliance with the requirements of 40 CFR Part 264, Subpart G in implementing the decontamination and removal of the tanks and ponds so that this action complies with the performance standard stated in Section 264.111. A plan for the decontamination and removal of the tanks and ponds will be provided for review as part of the Implementation Document for this IRA.

9.5 COMPLIANCE WITH THE OTHER ENVIRONMENTAL LAWS

As is evident from the various portions of this document, this IRA was prepared in substantive compliance with CFR 1502.16 (the regulations implementing the National Environmental Policy Act of 1969).

10.0 SCHEDULE

The Draft Implementation Document (design) is scheduled for completion on 21 December 1990. Predesign testing and preparation of final design documents have been incorporated into the schedule for the Implementation Document for this IRA. This milestone has been developed based on the assumption that no dispute resolution will be required during finalization of the Decision Document. If events which necessitate a schedule change or extension occur, the change will be incorporated in accordance with the procedures set forth in the Federal Facility Agreement.

11.0 CONSISTENCY OF IRA WITH THE FINAL REMEDIAL ACTION

The Federal Facility Agreement states that all IRAs shall "to the maximum extent practicable, be consistent with and contribute to the efficient performance of Final Response Actions" (paragraph 22.5, U.S. Environmental Protection Agency, et.al., 1988).

The Basin F Liquid IRA consists of treatment of the entire liquid waste body. The IRA removes a significant amount of contaminated material from temporary storage, treats it, and removes treatment residuals off-site. Any portion of the storage tank contents which cannot be fed to the SQI will be managed with the Basin F soils and addressed by the On-post Record of Decision or an additional IRA phase, if necessary. Therefore, this IRA is consistent with and contributes to the efficient performance of Final Response Actions.

12.0 REFERENCES

U.S. Environmental Protection Agency, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, October 1988, OWSER Directive 9355.3-01.

U.S. Environmental Protection Agency, Region VIII, U.S. Department of the Army, U.S. Department of the Interior, Rocky Mountain Region, and Agency for Toxic Substances and Disease Registry, 1989, Federal Facility Agreement Pursuant to CERCLA Section 120, Docket No. CERCLA VIII-89-13.

Woodward-Clyde Consultants, 1989a, Final Task Plan, Task IRA-2, Basin F Liquids Treatment Design, March 1989, Version 3.0.

Woodward-Clyde Consultants, 1989b, Final Treatment Assessment Report, Task IRA-2, Basin F Liquid Treatment Design, December 1989, Version 3.0.